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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

#18 Appeal Brief 7/5/02

In re Application for:)
Li-Shun Wang, John Chu)
Serial No.: 09/476,633)
Filed: December 31, 1999)
For: REMOVAL OF RESIDUE)
FROM A SUBSTRATE)

Examiner: Garcia, J.

Art Group: 2823

Assistant Commissioner for Patents
Washington, D.C. 20231

Attn: Board of Patent Appeals and Interferences

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APPEAL BRIEF

Applicants respectfully submit, in triplicate, the following Appeal Brief pursuant to 37 C.F.R. 1.192 for consideration by the Board of Patent Appeals and Interferences (hereinafter referred to as "Board"). Applicants also submit herewith a check in the amount of \$320.00 to cover the cost of filing this Appeal Brief. Please charge any additional amount due or credit any overpayment to Deposit Account 02-2666.

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I. REAL PARTY IN INTEREST

The real party in interest with regard to this appeal is Intel Corporation.

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to Applicants, Applicants' legal representative, or Applicants' assignee that will directly affect, be directly affected by, or have a bearing upon the Board's decision in this appeal.

III. STATUS OF CLAIMS

Claims 1-4 and 6-28 all of which stand rejected, are pending in the Application. Claims 1-4, 7, 9-12, 15, 18, 19 and 26-28 stand rejected under 35 U.S.C. § 102(e). Claims 6-8, 13, 14, 16, 17 and 20-22 stand rejected under 35 U.S.C. § 103(a). Claims 23-26 stand rejected under 35 U.S.C. § 112, first paragraph.

The Patent Office's decision on claims 1-4 and 6-28 in respect of all of the grounds stated above is appealed.

IV. STATUS OF AMENDMENTS

As indicated in the Advisory Action mailed on March 18, 2002, no after final amendments have been submitted, and, therefore, none have been entered. The Appendix attached herewith recites the pending claims.

V. SUMMARY

In an embodiment, the subject matter relates generally to integrated circuits and more specifically to a method and an apparatus for removing a particle from a portion of a metal layer over a substrate. The various embodiments disclosed generally relate to a method and an apparatus for polishing and rinsing a metal layer on a substrate. In embodiments, after polishing a metal layer, a rinsing agent comprising hydrogen peroxide is introduced to rinse a surface.

VI. GROUPING OF THE CLAIMS

Applicants request that claims be grouped as follows:

- Group I: claims 1-4, 6-22 and 27-28; and
- Group II: claims 23-26

VII. ISSUES PRESENTED

The issues presented in this Appeal are as follows:

(A) Whether, under 35 U.S.C. § 102(e), claims 1-4, 7, 9-12, 15, 18 and 19 are anticipated by U.S. Patent No. 6,159,858 issued to Kishii, et al. ("Kishii");

(B) Whether, under 35 U.S.C. § 103(a), claims 6, 8, 13, 14, 16, 17, and 20-22 are obvious over Kishii as applied to claims 1-4, 7, 9-12, 15, 18 and 19; and

(C) Whether the specification describes the subject matter claimed in claims 23-26 in sufficient detail that one skilled in the art could reasonably conclude that Applicants had possession of such claimed subject matter in accordance with the written description requirement of 35 U.S.C. § 112, first paragraph.

VIII. ARGUMENT

A. 35 U.S.C. § 102(e): Rejection of Claims 1-4, 7, 9-12, 15, 18, 19 and 26-28

The United States Patent and Trademark Office (USPTO) rejects Claims 1-4, 7, 9-12, 15, and 18-19 under 35 U.S.C. § 102(e) as anticipated by Kishii. For the following reasons, Applicants respectfully disagree with the rejection of these claims under 35 U.S.C. § 102(e).

(1) Rejection of Claim 1

In order to anticipate a claim, the relied upon reference must teach each and every limitation of the claim. Claim 1 discloses a method for removing a particle from a surface of a metal plug formed in a via, wherein after a metal layer has been polished with a first agent, a second agent comprising hydrogen peroxide is introduced to rinse the surface of a metal plug and at least one particle is removed from the surface of the metal plug.

Kishii discloses a slurry containing manganese oxide that is used to polish the elements of a conductive layer until an insulation layer is exposed, and then a layer of the substrate is cleaned using a cleaning solution containing acid, hydrogen peroxide and water so as to dissolve abrasive material. (Kishii, col. 14, lines 49-50, and Claim 1 of Kishii). The Patent Office characterizes Kishii as "rinsing the surface of the metal plug with a solution comprising hydrogen peroxide." (see Office Action, mailed June 20, 2001, page 2). Applicants respectfully submit that the Patent Office has mischaracterized Kishii. Kishii does not disclose rinsing the surface of a plug; only cleaning of a substrate using a cleaning solution containing acid, hydrogen peroxide and water, so as to dissolve abrasive material is disclosed in Kishii. (See Kishii, col. 14, lines 49-50, and claim 1 of Kishii). At least for this reason, Applicants submit that Kishii does not anticipate claim 1, which discloses rinsing with an agent comprising hydrogen peroxide.

The Patent Office has taken the position that one skilled in the art would not consider "rinsing" and "cleaning" to be capable of not being considered synonymous in the art of integrated circuit processing. In their previous responses to office action in respect of the pending application, Applicants have cited reputable publications in the art that refer to "rinsing" and "cleaning" as not being synonymous terms. However, the Patent Office has not yet been persuaded. In this Appeal Brief, Applicants again present evidence in this regard, with the expectation that the Board of Patent Appeals and Interferences will recognize that these terms may be considered to not be synonymous by those skilled in the art, and, as a result, the claims of Kishii that are directed to "cleaning" do not anticipate Applicants' claims directed to "rinsing."

For example, J. Ruzyllo's Semiconductor Glossary, which is a popular glossary of semiconductor terminology, has separately defined these terms. In this glossary, as shown by Exhibit A attached herewith, "cleaning" has been defined as a:

"process of removing contaminants (particles as well as metallic and organic) from the surface of the wafer", (J. Ruzyllo, Semiconductor Glossary, 2001, <<http://semiconductor glossary.com>>).

As shown by Exhibit B attached herewith, J. Ruzyllo's glossary describes "rinsing" as a:

"process in which [a] wafer is immersed in deionized water in order to stop chemical reactions initiated during preceding operation and to remove products of these reactions from the surface." (*Id.*).

These definitions, as well as the mere fact that separate definitions are provided for each term, provide evidence that those skilled in the art do not consider these terms to be synonymous. For example, wafers are often cleaned with solutions containing acid, and then later rinsed with de-ionized water. One purpose of rinsing is to reduce water spots and other leftover residues left over from cleaning, which can cause defects such as submicron contaminants on wafers prior to the next process step.

As another example that evidences that "cleaning" and "rinsing" can be considered to not be synonymous, Applicants have also called the Patent Office's attention to page 91 of the book Semiconductor Terminology by Michael Heynes, Ph.D. and Anne K. Miller (Semiconductor Services, Third Edition, 1999). A copy of this page is attached as Exhibit C. As shown in Exhibit C, "rinse" is defined by the authors as "[t]he removal of cleaning solutions, etchants or developers etc, from the wafer using water. This process stops processes by removing the active chemical from the surface." The definition of "rinse" found in Semiconductor Terminology, by stating that "rinse" is "the removal of cleaning solutions . . .", clearly indicates that "clean" and "rinse" are capable of being regarded as terms that are not synonymous. Applicants submit these definitions for the purpose of supporting the proposition that "cleaning" and "rinsing" may be regarded as not being synonymous terms, by those skilled in the art of semiconductor processing.

Applicants believe that by pointing out that these terms have been defined separately by those skilled in the art, such as the authors of the above-identified glossary and book, Applicants have provided a sufficient basis to establish that these terms are not considered to be synonymous to those skilled in the art.

In the Final Office Action mailed on December 17, 2001, the Patent Office cites and applies a definition of the term "rinse" from Merriam-Webster's On-Line Collegiate Dictionary. The Court of Appeals for the Federal Circuit has

"previously cautioned against the use of non-scientific dictionaries lest dictionary definitions be converted into technical terms of art having legal, not linguistic significance."

Bell Atlantic Network Servs., Inc. v. Covad Comms. Group, Inc., 262 F.3d 1258,1268 (Fed. Cir. 2001), citing Multiform Desiccants, Inc. v. Medzam, Ltd., 133 F.3d 1473, 1478 (Fed. Cir. 1998). Therefore, when determining the meaning of a term to one of ordinary skill in the art, definitions found in scientific dictionaries are preferable to definitions found in non-scientific dictionaries. Accordingly, given that "rinse" is defined in a number of scientific dictionaries that pertain directly to the art of semiconductor processing, Applicants submit that the Patent Office improperly relied on a definition from a non-scientific dictionary.

Applicants note that the art-related definitions cited above by the Applicants state that rinsing is performed using water. The Patent Office states that because the agent used in rinsing (claim 1), the solution for rinsing (claim 9) and the rinsing solution (claim 18) disclosed by Applicants comprises hydrogen peroxide, the rinsing recited in these claims falls outside of the definition of "rinse" provided in the J.Ruzylo's online semiconductor glossary. See Final Office Action mailed on December 17, 2001, at page 2. First, Applicants note that the definitions in J.Ruzylo's online semiconductor glossary were presented in Applicants' prior responses to the Patent Office merely to demonstrate that the terms "clean" and "rinse" may be considered as terms that are not synonymous, by those skilled in the art. The definitions were not presented, and are not here presented, for the purpose of limiting the scope of Applicants' claimed subject matter. Moreover, the preferred scientific definitions of "rinse", that have been cited by Applicants, do not state or imply that agents used in rinsing or rinsing solutions must contain only water. Only the non-preferred, non-scientific definition of this term, that was cited by the Patent Office, appears to contain language intimating that an agent or rinsing solution might be considered to contain only water. As stated above, the Court of Appeals of the Federal Circuit has cautioned against the use of such a non-scientific definition.

Furthermore, the scientific definitions, as well as any non-scientific definitions if they are to be applied, should not be applied dogmatically so that "rinse" would only refer to solutions consisting entirely of "water," as such an application might not even cover agents or rinsing solutions using only "deionized water." The application filed by Applicants on December 31, 1999 discloses, at lines 15-19 of page 8:

"In one embodiment, the rinsing solution comprises approximately 4% by volume of hydrogen peroxide, and generally comprises hydrogen peroxide in the approximate range of 2% to 4.5%. . . . The remainder of the rinse contains deionized water."

Therefore, the pending application clearly discloses the use of rinsing solutions that do not consist entirely of water. The Patent Office appears to be taking the position that an agent or solution used in rinsing, such as those disclosed in the cited embodiments, cannot be considered rinses because they contain from 2% to 4.5% hydrogen peroxide, and do not contain only "water." The construction proposed by the Patent Office is strained, as it would prevent agents, solutions or rinsing solutions from being considered to be rinses simply because they contain even small amounts of chemicals in addition to water. Such a construction would *ipso facto* eliminate the possibility of any patentable improvements in the make-up of agents for rinsing or rinsing solutions and would discourage research in this area of rinsing semiconductor wafers. Accordingly, Applicants respectfully disagree with the Patent Office's position that Applicants' claimed rinsing solution cannot be considered a "rinse" because it contains hydrogen peroxide.

Based on the foregoing, Applicants respectfully submit that Kishii does not teach "rinsing", and therefore does not teach each and every limitation of claim 1. Therefore, at least for the reasons stated above, Applicants submit that claim 1 is not anticipated by Kishii, and is in condition for allowance.

Claims 2-5 and 7 depend from claim 1, and, therefore, are also not anticipated by Kishii at least for the reasons stated above in regard to claim 1.

Because claims 9 and 18 concern rinsing and/or rinsing solutions comprising hydrogen peroxide, Applicants arguments in regard to independent claims 9 and 18 are similar to the argument set forth above in respect of claim 1. Therefore, at least for the reasons stated above in respect to claim 1, claims 9 and 18 are also not anticipated by Kishii. More specifically, claim 9 recites a method comprising rinsing the surface of a metal plug with a solution comprising hydrogen peroxide. As stated above, Applicants submit that Kishii does not disclose rinsing, or, for that matter, the use of a solution comprising hydrogen peroxide to rinse a substrate. Independent claim 18 recites a method comprising introducing a rinsing solution onto a conductive plug, with the

rinsing solution comprising hydrogen peroxide. Again, Applicants submit that Kishii does not disclose introducing a rinsing solution comprising hydrogen peroxide onto a conductive plug.

Claims 10-12 and 15 depend from claim 9, and, therefore, are also not anticipated at least for the reason stated above in regard to claim 9. Claim 19 depends from claim 18 and, therefore, is not anticipated at least for the reason stated above in regard to claim 18.

Independent claims 26-28 recite "introducing a second agent consisting essentially of hydrogen peroxide to rinse the surface of the metal plug" (claim 26), "rinsing the surface of the metal plug with a solution consisting essentially of hydrogen peroxide" (claim 27), and "introducing a rinsing solution onto the conductive plug, the rinsing solution consisting essentially of hydrogen peroxide" (claim 28). As stated above, Kishii does not disclose rinsing with an agent, solution or rinsing solution comprising hydrogen peroxide. Therefore, logically, it cannot anticipate a claim reciting an agent, solution or rinsing solution consisting essentially of hydrogen peroxide, because the latter claims reciting the transitional phrase "consisting essentially" are narrower than the claims using the transitional word "comprising".

Accordingly, based on the foregoing, Applicants respectfully request withdrawal of the rejection of claims 1-4, 7, 9-12, 15, 18, 19 and 26-28 under 35 U.S.C. § 102(e).

B. 35 U.S.C. § 103(a): Rejection of Claims 6, 8, 13, 14, 16, 17 and 20-22

Claims 6, 8, 13-14, 16-17, and 20-22 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Kishii as applied to claims 1-4,¹ 7, 9-12, 15, and 18-19. In order to render a claim obvious, the relied upon reference(s) must teach or suggest every limitation of the claim such that the invention as a whole would have been obvious to one skilled in the art at the time the invention was made.

Claim 1, from which claims 6 and 8 depend, discloses rinsing with an agent comprising hydrogen peroxide. Therefore, dependent claims 6 and 8 also contain this limitation. As discussed above, Kishii does not teach or suggest rinsing a surface of a metal plug. Instead, Kishii only teaches an "acid cleaning process" (Kishii, col. 14, lines

¹ In the Final Office Action, mailed on December 17, 2001, the Patent Office cites Kishii as applied to claims 1-5, 7, 9-12, 15, and 18-19, as the basis for the obviousness rejection. Applicants note, however, that claim 5 has been canceled. Accordingly, throughout this brief, Applicants do not refer to claim 5 when addressing the grounds for the obviousness rejection.

56-57). The hydrogen peroxide recited in Kishii is used as part of an acidic cleaning solution used in a "cleaning process" (see, generally, col. 4, lines 3-34). Kishii does not teach or suggest rinsing, and, more specifically, does not suggest using hydrogen peroxide for rinsing a metal plug. Therefore, Kishii does not teach or suggest every limitation of independent Claims 1 such that the invention as a whole would have been obvious at the time the invention was made to one skilled in the art. Therefore, claims 6 and 8, which depend from claim 1, and contain all of the limitations of claim 1, are also not rendered obvious by Kishii as applied to claims 1-4, 7, 9-12, 15, and 18-19. Accordingly, Kishii as applied to Claims 1-4, 7, 9-12, 15, and 18-19 is an improper basis for an obviousness rejection of Claims 6 and 8, and does not establish a *prima facie* case of obviousness.

Claims 13, 14 and 16 depend from claim 9, which discloses rinsing with a solution comprising hydrogen peroxide. As stated above, Kishii does not teach or suggest rinsing, or the use of solutions comprising hydrogen peroxide in rinsing. At least for the reason that claims 13, 14 and 16 contain this limitation, they cannot be rendered obvious by Kishii.

Claims 20-22 depend from claim 18, which discloses introducing a rinsing solution comprising hydrogen peroxide. As stated above, Kishii does not teach or suggest rinsing or the use of rinsing solutions comprising hydrogen peroxide. At least for the reason that claims 20-22 contain this limitation, they cannot be rendered obvious by Kishii.

Accordingly, withdrawal of the rejection of Claims 6, 8, 13-14, 16-17, and 20-22 under 35 U.S.C. § 103(a) is respectfully requested. Because Kishii as applied to claims 1-4, 7, 9-12, 15, and 18-19 is an improper basis for an obviousness rejection, Applicants respectfully submit that, without prejudice, Applicants are not required to address the Patent Office's contention that claims 6, 8, 13-14, 16-17, and 20-22 represent matters of routine optimization.

C. 35 U.S.C. § 112, First Paragraph, Written Description Requirement: Rejection of Claims 23-26

Claims 23-26 were rejected by the Patent Office under the written description requirement of 35 U.S.C. § 112, first paragraph. To satisfy the written description requirement, a patent specification must describe the claimed invention in sufficient

detail that one skilled in the art could reasonably conclude that the inventor had possession of the claimed invention.

The Patent Office rejects claims 23-26 under the written description requirement of 35 U.S.C. § 112, first paragraph, as failing to convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. Claims 23-25 recite agents, solutions and rinsing solutions consisting of hydrogen peroxide. Claim 26 recites an agent consisting essentially of hydrogen peroxide. The specification of the applications, as filed (see line 7, page 7), states "[t]he metal layer is then rinsed with a solution that comprises hydrogen peroxide." Additionally, it is well established that the originally filed claims are part of the specification. In this regard, claims 1, 9 and 18, as filed, all recited agents, solutions or rinsing solutions comprising hydrogen peroxide. Therefore, it is clear that the specification, as filed, disclosed agents, solutions and rinsing solutions comprising hydrogen peroxide.

Accordingly, Applicants submit that the specification supports claims disclosing agents, solutions or rinsing solutions that contain any amount or ratio of hydrogen peroxide. A solution that consists of hydrogen peroxide or that consists essentially of hydrogen peroxide surely also comprises hydrogen peroxide. In this regard, it is well recognized that "comprising" is broader than "consisting" or "consisting essentially". Accordingly, a claim reciting a substance comprising chemical X inherently supports claims reciting substances that "consist of" or "consist essentially of" chemical X. Therefore, it is submitted that agents, solutions or rinsing solutions consisting of, or consisting essentially of, hydrogen peroxide are supported by the specification of the application, as filed. As such, the application, as filed, conveys to one skilled in the art that Applicants were in possession of the claimed subject matter.

At least for the reasons stated above, Applicants submit that claims 23-26 meet the written description requirements of 35 U.S.C. § 112. The Final Office Action, that was mailed on December 17, 2001, does not appear to reject claims 27 and 28 under the written description requirement. In any event, if the Patent Office did intend to reject these claims as well, Applicants submit that claims 27 and 28 meet the written description requirement at least for the same reasons that claims 23-26 meet the requirement. Accordingly, Applicants request withdrawal of the rejections of claims 23-26 (and 27 and 28, if applicable) under 35 U.S.C. § 112.

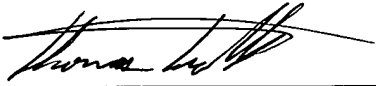
IX. CONCLUSION

In view of the foregoing, Applicants respectfully submit that all appealed claims satisfy all requirements of 35 U.S.C. § 102(e), 35 U.S.C. § 103(a) and 35 U.S.C. § 112, first paragraph and are in condition for allowance.

Respectfully Submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Dated: May 17, 2002

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Attachment: APPENDIX A: COPY OF PENDING CLAIMS

- EXHIBIT A: EXCERPT FROM J.RUZYLLLO'S SEMICONDUCTOR GLOSSARY (DEFINING "RINSING")
- EXHIBIT B: EXCERPT FROM J.RUZYLLLO'S SEMICONDUCTOR GLOSSARY (DEFINING "CLEANING")
- EXHIBIT C: EXCERPT FROM SEMICONDUCTOR TERMINOLOGY, BY MICHAEL HEYNES, PH.D., ET AL (DEFINING "RINSE")

APPENDIX A**PENDING CLAIMS**

1. (Three Times Amended) A method of removing a particle from a surface of a metal plug formed in a via comprising:
 - introducing a first agent to a metal layer;
 - polishing the metal layer with the first agent;
 - after polishing the metal layer, introducing a second agent comprising hydrogen peroxide to rinse the surface of the metal plug; and
 - removing at least one particle from the surface of the metal plug.
2. The method of claim 1, wherein polishing the metal layer comprises polishing a metal material selected from the group consisting of tungsten and copper.
3. The method of claim 1, wherein polishing the metal layer comprises polishing with the first agent having an abrasive material selected from the group consisting of silica, alumina, zirconia, and ceria.
4. The method of claim 1, wherein polishing comprises chemical mechanical polishing.
6. The method of claim 1, wherein introducing the second agent comprises introducing a second agent of approximately 4% by volume or less of hydrogen peroxide.
7. The method of claim 1, further comprising polishing the substrate with the second agent.

8. The method of claim 1, wherein polishing the metal layer with the second agent includes polishing with a polisher operating at a polishing pressure approximately in the range of 0.5 to 2.0 psi.
9. (Three Times Amended) A method of removing at least one particle from a surface of a metal plug disposed over a substrate comprising:
 - depositing a slurry onto a metal layer over the metal plug;
 - polishing the metal layer; and
 - after polishing the metal layer, rinsing the surface of the metal plug with a solution comprising hydrogen peroxide.
10. The method of claim 9, wherein polishing the metal layer comprises polishing a metal material selected from the group consisting of tungsten, copper, and aluminum.
11. The method of claim 9, wherein depositing the slurry further comprises depositing a slurry having an abrasive material selected from the group consisting of silica, alumina, zirconia, and ceria.
12. (Once Amended) The method of claim 9, wherein rinsing the metal plug occurs after polishing the metal layer and substrate.
13. (Once Amended) The method of claim 9, wherein rinsing the metal plug comprises rinsing with the solution which comprises approximately 4% by volume or less of hydrogen peroxide.
14. (Twice amended) The method of claim 9, wherein polishing the metal layer includes removing the metal layer at a rate of approximately in the range of 40Å/minute to 80Å/minute.

15. The method of claim 9, wherein polishing comprises chemical mechanical polishing.
16. The method of claim 9, wherein rinsing occurs during polishing; and polishing comprises polishing with a polisher at a polishing pressure approximately in the range of 0.5 to 2.0 psi.
17. The method of claim 16, wherein the metal layer is removed at a rate of 60Å/minute.
18. (Three Times Amended) A method comprising:
polishing a metal layer over a conductive plug with a slurry;
after polishing the metal layer, introducing a rinsing solution onto the conductive plug, the rinsing solution comprises hydrogen peroxide.
19. (Twice amended) The method of claim 18, further including polishing the metal layer with an abrasive material, wherein the rinsing solution is introduced after polishing of the substrate.
20. The method of claim 18, wherein introducing a rinsing solution comprises introducing a rinsing solution of approximately 4% by volume or less of hydrogen peroxide.
21. The method of claim 18, wherein introducing a rinsing solution occurs during polishing the metal layer in which a polishing pressure is used approximately in the range of 0.5 to 2.0 psi.

22. The method of claim 18, wherein a metal layer is removed at a rate of 60Å/minute.
23. A method of removing a particle from a surface of a metal plug formed in a via comprising:
introducing a first agent to a metal layer;
polishing the metal layer with the first agent; and
after polishing the metal layer, introducing a second agent consisting of hydrogen peroxide to rinse the surface of the metal plug.
24. A method of removing at least one particle from a surface of a metal plug disposed over a substrate comprising:
depositing a slurry onto a metal layer over the metal plug;
polishing the metal layer; and
after polishing the metal layer, rinsing the surface of the metal plug with a solution consisting of hydrogen peroxide.
25. A method comprising:
polishing a metal layer over a conductive plug with a slurry;
after polishing the metal layer, introducing a rinsing solution onto the conductive plug, the rinsing solution consisting of hydrogen peroxide.
26. A method of removing a particle from a surface of a metal plug formed in a via comprising:
introducing a first agent to a metal layer;
polishing the metal layer with the first agent; and
after polishing the metal layer, introducing a second agent consisting essentially of hydrogen peroxide to rinse the surface of the metal plug.

27. A method of removing at least one particle from a surface of a metal plug disposed over a substrate comprising:
- depositing a slurry onto a metal layer over the metal plug;
 - polishing the metal layer; and
 - after polishing the metal layer, rinsing the surface of the metal plug with a solution consisting essentially of hydrogen peroxide.
28. A method comprising:
- polishing a metal layer over a conductive plug with a slurry;
 - after polishing the metal layer, introducing a rinsing solution onto the conductive plug, the rinsing solution consisting essentially of hydrogen peroxide.